

GAO

Briefing Report to the Honorable  
John Heinz, U.S. Senate

August 1988

# INDUSTRIAL BASE

## Defense-Critical Industries



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United States  
General Accounting Office  
Washington, D.C. 20548

National Security and  
International Affairs Division

B-231595

August 15, 1988

The Honorable John Heinz  
United States Senate

Dear Senator Heinz:

As requested in your September 29, 1987, letter and subsequent discussions with your Office, we are providing (1) information on what the Department of Defense (DOD) and other federal agencies are doing to identify and assist American industries that are critical to the defense industrial base, (2) our assessment of the methodology used by the Logistics Management Institute (LMI)<sup>1</sup> to define and evaluate the strength of the defense industrial base,<sup>2</sup> and (3) information on DOD prime contract awards to foreign sources. The LMI analysis represents an initial step in identifying American industries that are critical to the defense industrial base.

As agreed, we focused our review efforts on

- identifying the federal agencies that play a significant role in maintaining the defense industrial base and strengthening industries deemed critical to national security,
- summarizing these agencies' efforts to identify defense-critical industries,
- determining the agencies' actions and proposals to enhance or maintain the viability of defense-critical industries, and
- obtaining DOD's and other agencies' views regarding selected industries.

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<sup>1</sup>LMI is a Federally Funded Research and Development Center. Its research and evaluation efforts are focused on procurement, logistics, material management, personnel support, and other related areas.

<sup>2</sup>DOD contracted with LMI for the evaluation.

This letter summarizes the results of our review and appendixes I through VI provide more detail. The tables in appendix II, which are based on LMI data, identify defense-critical industries and show the performance of selected industries based on six economic indicators.

DOD is concerned about serious indications of decline in sectors of the industrial base that are important to national security. In early 1987, DOD began an initiative to improve the competitiveness of U.S. industries critical to the defense industrial base. The initiative's objectives included, among other things, exploring the national security implications of an increasingly competitive world economy.

DOD's initiative has involved industry, academia, and, to some extent, experts from the agencies that play a significant role in identifying and maintaining the defense industrial base. As part of this overall effort, DOD conducted a series of workshops on aspects of industrial competitiveness, such as research and development, product and process engineering, production, finance, purchasing, post manufacturing actions, and public policy.

The LMI study was another part of this initiative. DOD contracted with LMI to conduct a quick reaction study to assess whether the overall strength of the industrial base masks any weaknesses in individual defense-critical industries. DOD incorporated the results of LMI's evaluation and the workshops into a draft report that summarized its views. This draft report was reviewed and critiqued at the "Defense Industrial Strategy Conference," hosted by the National Defense University on December 10, 1987.

On July 15, 1988, after revising the draft report, the Under Secretary of Defense (Acquisition) released the final report, Bolstering Defense Industrial Competitiveness, to the Secretary of Defense. This report summarizes the results of DOD's initiative to date. That is, it discusses (1) DOD's views, including the reasons for DOD's concern about U.S. industrial strength, the nature and scope of our competitiveness problems, and DOD's role in addressing them; (2) causes of and potential solutions to long-term problems; and (3) recommendations for DOD actions. The Under Secretary's report includes a definition of defense-critical industries and an assessment of these industries' overall economic performance, both of which were based on the LMI study.

DOD officials said that they hoped this initiative would ultimately produce industry and government consensus on a plan that will, among other things, provide a method for identifying weak industry sectors in need of attention and a methodology to ensure a broad look at potential remedies for these sectors.

AGENCIES INVOLVED WITH THE  
DEFENSE INDUSTRIAL BASE

DOD has identified seven government agencies or offices that play a significant role in identifying and maintaining the defense industrial base: DOD; the Departments of Energy, the Interior, Commerce, and the Treasury; the Federal Emergency Management Agency (FEMA); and the Office of the U.S. Trade Representative. DOD and Commerce have the most important roles. DOD has a leadership role in assessing and maintaining the viability of defense-critical industries. Defense-critical industries, as defined by LMI and included in the Under Secretary's report, are those in which the majority of DOD's budget is spent, directly or indirectly, as well as industries vital to defense production. Commerce's mission includes (1) developing programs and policies relating to national security and industry and (2) assuring the availability of industrial resources to meet U.S. peacetime and emergency requirements.

DOD has begun and plans to continue its efforts to identify industries that are critical to the defense industrial base as part of its initiative to bolster industrial competitiveness of such industries. The other agencies described their roles in this initiative as reactive. That is, they have voiced their opinions on problems as perceived and presented by DOD, but were not involved in devising the methodology to identify critical industries in the manufacturing sector and assessing their problems.

Agencies Perspectives and Concerns

Agencies' senior officials who have been designated as agency representatives to the interagency discussions on the defense industrial base expressed concerns regarding DOD's views on defense-critical industries. The most serious concern voiced was that DOD has not accurately represented the problems of these industries. A Treasury official said that the omission of important variables--like the impact the exchange rate would have on these industries--in the approach

used to assess the health of critical industries has distorted the picture and that DOD still needs to identify the underlying causes of specific industry sector problems. Therefore, the official believes it is premature to seek an action plan. This official suggested that the Economic Policy Council<sup>3</sup> establish a working group, including DOD, to clarify the problems of the defense-critical industries and examine the options available to address the specific problems identified. In response to this suggestion, the Under Secretary's report states that preliminary discussions concerning cooperative efforts have been held with Treasury and the Economic Policy Council.

Another important concern, which was expressed by the Interior representative, was the need to prioritize the critical industries and minerals so that agencies can adequately consider national security in their policy and program decisions and target limited resources to those industries deemed most critical. For example, an Interior research program is attempting to identify alternative methods to recover minerals that no longer can be mined economically by conventional means. Current research efforts are concentrated on new techniques to extract copper. The Interior representative stated that efforts of this kind could be applied to other minerals if DOD identified them as priorities for national security.

The Commerce representative expressed concern about the effect of military offset agreements on the competitiveness of defense industries and stated this was an additional factor that should be taken into account in defense industrial base planning. Offsets represent a range of industrial and commercial compensation practices, such as coproduction, that other countries impose as conditions when purchasing U.S. military exports. Although some offset agreements may have enhanced standardization and modernization of allied forces, they can also reduce a country's competitive advantages. For example, some

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<sup>3</sup>The Economic Policy Council is composed of the Secretaries of State, Treasury, Agriculture, Commerce, and Labor, the Director of the Office of Management and Budget, the United States Trade Representative, and the Chairman of the Council of Economic Advisors. Other cabinet officials also attend when the Council discusses matters of interest to them. The Council advises the President on all aspects of national and international economic policy.

agreements require the transfer of specific technology and production management expertise from the United States to foreign countries. Recent U.S. government studies have identified examples of U.S. industry sectors which offset agreements have hurt.

Despite these kinds of concerns, DOD believes that its initial effort to identify and assess defense-critical industries has been beneficial because it has begun the interagency dialogue on issues important to national security.

Programs to Assist  
Defense-Critical Industries

A DOD Office of Industrial Resources representative identified five industrywide programs to enhance and support industries critical to DOD. These programs include semiconductors, gas turbine engines, machine tools, bearings, and forgings. This official, who has had major responsibility for the Under Secretary's report on industrial competitiveness, said that these industrywide programs reflect a reaction to specific industry problems and complaints, rather than a systematic analysis of problems in the defense-critical industries. The official also said that DOD's procurement and research policies, such as restrictions on foreign source procurement, may not be sufficient to enhance some key defense industries.

ASSESSMENT OF LMI'S METHODOLOGY

LMI's report, Identifying Industrial Base Deficiencies, prepared in response to DOD's request, was a quick reaction study to evaluate the overall strength of the U.S. industrial base and assess whether the general strength of the base masks any weaknesses in individual defense-critical industries. LMI developed this assessment in a 2-month period.

LMI's evaluation of the status of the defense industrial base involved identifying defense-critical industries and examining those industries' competitive positions, capacities, productivity, and profitability. In identifying defense-critical industries LMI used two sources: the Defense Economic Modelling System, a model of the U.S. economy combined with the defense budget to estimate DOD demand for all industrial sectors, and the Department of Commerce report, Shipments to Federal Agencies. To assess

these industries' economic performance, LMI used six economic indicators. (See app. II.)

While LMI's methodology for evaluating the strength of the defense industrial base was basically sound, we believe further work is needed to refine the definition of a defense-critical industry. For example, some of the 215 industries that LMI identified as "defense critical" are not clearly critical to the national defense effort. We also believe that the six economic indicators LMI used to assess general performance of those industries determined to be critical are reasonable. (See app. II.) LMI stated, and we agree, that additional indicators, such as each of the defense-critical industries' share in the world market and its growth in expenditures on research and development, would have been useful to include in the analysis. However, LMI noted that the time constraints on the project as well as the unavailability of some of the data prevented such expanded analysis.

LMI's study did not attempt to take into account the relative importance of the various industries in terms of national security requirements. Establishing priorities would further sharpen the definition of the critical defense industrial base. According to LMI, industries for which poor performance is indicated are possible candidates for government "intervention", but only after the government performs a thorough industry analysis of national security requirements and individual industry capability to meet these requirements.

#### DOD PRIME CONTRACT AWARDS TO FOREIGN SOURCES

Some have linked DOD procurement of key parts and components from foreign sources to the decline of U.S. industries in the lower tiers of defense production. They argue that while foreign sources in the short term may result in timely and reliable deliveries, better quality, and lower cost, foreign dependency may evolve over time into a vulnerability.

We obtained data on the products and services that accounted for the vast majority of the dollar value of DOD contracts to foreign sources in recent years. The information showed no significant increase in the value of DOD prime contract awards to foreign sources. Because systematic information on subcontract awards is not readily available and would be

costly to obtain, we did not identify foreign source procurement awards at the subcontractor level.

The Under Secretary's report stated that (1) DOD does not know the extent to which foreign sourced parts and components are incorporated in the systems it acquires and (2) in a national emergency, the consequences of extensive dependence on foreign sources could be extreme.

Details of the results of our review are in the appendixes. Appendix I contains information on industries critical to the defense industrial base. Appendix II provides, based on LMI's results, information on efforts to identify defense-critical industries and their deficiencies, including the performance of the following selected industries: ball and roller bearings, iron and steel forgings, screw machine products and fasteners, and semiconductors and related products. Appendix III describes several industrywide programs which DOD and Commerce established to identify and address specific problems of defense-critical industries. Appendix IV lists selected industry sector studies prepared for DOD and Commerce. Appendix V provides the information on DOD's prime contract awards to foreign sources. Appendix VI describes our objectives, scope, and methodology.

. . . . .

As you requested, we did not obtain official agency comments on this report. However, we discussed its contents with DOD officials from the Office of the Secretary of Defense, Office of Industrial Resources and included their comments where appropriate.

Unless you publicly announce its contents earlier, we plan no further distribution of the report until 30 days from the date of the report. At that time, we will send copies to the Secretaries of Commerce, Defense, Energy, the Interior, and

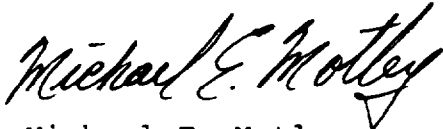


B-231595

the Treasury; the Director of the Federal Emergency Management Agency; the United States Trade Representative; and to other interested parties.

If you have any questions, please call me on 275-8400.

Sincerely yours,

A handwritten signature in cursive script that reads "Michael E. Motley". The signature is written in black ink and is positioned above the typed name.

Michael E. Motley  
Associate Director

C o n t e n t s

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#### ABBREVIATIONS

|       |  |
|-------|--|
| DEIMS | Defense Economic Impact Modelling System   |
| DOD   | Department of Defense                      |
| FEMA  | Federal Emergency Management Agency        |
| IMIP  | Industrial Modernization Incentive Program |
| LMI   | Logistics Management Institute             |
| NBS   | National Bureau of Standards               |
| OUSTR | Office of the U.S. Trade Representative    |
| SIC   | Standard Industrial Classification         |

INDUSTRIES CRITICAL TO  
THE DEFENSE INDUSTRIAL BASE

A number of federal agencies play a role in identifying and maintaining the defense industrial base. DOD, a major player, has an ongoing initiative to bolster industrial competitiveness that includes efforts to identify and address the problems of industries critical to the defense industrial base. As part of this initiative, DOD has consulted with other concerned agencies, and it contracted with LMI to identify and assess the strength of this base.

THE SIGNIFICANT AGENCIES

DOD identified several federal agencies or offices that play a significant role in identifying and maintaining the defense industrial base: DOD; the Departments of Commerce, Energy, the Interior, and the Treasury; the Federal Emergency Management Agency (FEMA); and the Office of the U.S. Trade Representative (OUSTR). DOD and Commerce have the major roles.

DOD has a leadership role that reflects its vital interest in maintaining the viability of defense-critical industries. These industries supply the many components, parts, and subsystems of sophisticated weapon systems and are an integral part of the U.S. manufacturing sector. DOD, because of U.S. national security interest, assesses the health of these defense-critical industries. DOD is seeking interagency consensus on a plan that will provide a method for identifying weak industry sectors in need of attention and a methodology to ensure a broad look at potential remedies. DOD recognizes that its influence is limited for industries that have large commercial markets. Although a relatively small portion of the total output of some industries goes to defense, DOD is nonetheless dependent on these industries for the effective operations of some weapon systems. For example, DOD's demand for bearings is not large enough to sustain the overall health of the industry, or to provide incentives for firms to invest in new equipment or train new workers.

Commerce has the mission to develop programs and policies relating to national security and industry, and assure the availability of industrial resources to meet peacetime and emergency requirements of the United States. Relevant Commerce

programs include: (1) Section 232 Investigations,<sup>1</sup> (2) Industrial Capabilities, (3) Stockpile Support, (4) Defense Offsets, and (5) Defense Production Act Authorities. In general, these programs seek to identify bottlenecks to industrial production which would be critical in the event of defense mobilization, recommend trade actions when the level of imports of a critical commodity threatens the national security by reducing our production base, allocate critical industrial resources to meet military requirements, analyze the effects of military offset agreements on U.S. industrial material, and ensure the availability of appropriate critical materials.

Each of the other concerned agencies brings its own perspective to the problems of the defense industrial base. For example, Interior analyzes the defense industrial base in terms of raw materials needs and deficiencies, while Energy considers the problems of energy as a key industry and commodity. FEMA coordinates and facilitates interagency discussions on DOD's efforts to bolster the defense industrial base. For example, FEMA established an informal interagency mechanism (Civil Agency Advisory Group) to (1) hold discussions on the ideas and approaches that DOD proposed to improve defense industrial competitiveness and (2) reach consensus on industry problems and solutions.

#### EFFORTS TO IDENTIFY DEFENSE-CRITICAL INDUSTRIES

DOD is concerned about serious indications of decline in sectors of the industrial base that are important to national security. In early 1987, DOD began an initiative to improve the competitiveness of U.S. industries critical to the defense industrial base. The initiative's objectives included, among other things, exploring the national security implications of an increasingly competitive world economy.

DOD's initiative has involved industry, academia, and, to some extent, experts from the agencies that play a significant role in identifying and maintaining the defense industrial base. As part of this overall effort, DOD conducted a series of workshops on

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<sup>1</sup>Under the authority of Section 232 of the Trade Expansion Act of 1962, as amended, the Secretary of Commerce, in consultation with the Secretary of Defense and other appropriate agencies, has the responsibility to determine the effect of imports on national security.

aspects of industrial competitiveness such as research and development, product and process engineering, production, finance, purchasing, post manufacturing actions, and public policy.

The LMI study was another part of this initiative. DOD contracted with LMI to conduct a quick reaction study to assess whether the overall strength of the industrial base masks any weaknesses in individual defense-critical industries. DOD incorporated the results of LMI's evaluation and the workshops into a draft report which summarized its views. This draft report was reviewed and critiqued at the "Defense Industrial Strategy Conference," hosted by the National Defense University on December 10, 1987.

On July 15, 1988, after revising the draft report, the Under Secretary of Defense (Acquisition) released the final report, Bolstering Defense Industrial Competitiveness, to the Secretary of Defense. This report summarizes the results of DOD's initiative to date. That is, it discusses (1) DOD's views, including the reasons for DOD's concern about U.S. industrial strength, the nature and scope of our competitiveness problems, and DOD's role in addressing them; (2) causes of and potential solutions to long-term problems; and (3) recommendations for DOD actions. The Under Secretary's report includes a definition of defense-critical industries and an assessment of these industries' overall economic performance, both of which were based on the LMI study.

The other agencies concerned described their roles in DOD's initiative as reactive. That is, they have voiced their opinions on problems as presented by DOD,<sup>2</sup> but were not involved in devising the methodology to identify the defense-critical industries in the manufacturing sector or defining their problems.

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<sup>2</sup>DOD's draft report and the Under Secretary's final report, Bolstering Defense Industrial Competitiveness, summarize the underlying causes of competitiveness problems in the overall U.S. industrial base and in that portion of it known as the defense industrial base. The causes of the competitiveness problems are grouped into three major categories: management issues, federal government policies and practices such as tax and regulatory policies, and educational and cultural issues.

DOD's Perspective Based  
on LMI's Assessment

Defense-critical industries, as defined by LMI and included in the Under Secretary's report on bolstering industrial competitiveness, are those in which the majority of DOD's budget is spent, directly or indirectly, as well as industries that the military services consider vital to defense production. Using the Defense Economic Impact Modelling System (DEIMS) and the Department of Commerce report, Shipments to Federal Agencies, LMI identified 215 defense-critical industries, which account for about 95 percent of DOD purchases from the manufacturing sector. (See app. II.)

To assess the defense-critical industries, LMI first assessed the strength of the U.S. manufacturing sector and analyzed its overall performance. LMI did this primarily to set standards for comparison with the defense-critical industries. LMI found that since 1960, U.S. manufacturing output, measured in constant dollars, has remained a stable component of the total economy, representing 20.3 percent of total gross national product in 1960 and 21.7 percent in 1985. (See table II.1.) LMI also found that these summary data on the manufacturing sector could mask weaknesses in specific defense industries. LMI then made comparisons, based on selected economic indicators, between the performance of defense-critical industries and the overall manufacturing sector.

LMI's evaluation of the defense-critical industries showed mixed results. Based on a composite of six economic indicators, which are discussed in appendix II and defined in tables II.4 through II.10, LMI ranked the critical industries to show those with the poorest performance. (Table II.2 provides the ranking.) According to LMI, industries for which poor performance is indicated are possible candidates for government "intervention," but only after the government performs a thorough industry analysis of national security requirements and individual industry capability to meet these requirements.

The six economic indicators applied to each industry were: import share of the domestic market; growth in capacity; growth in shipments; capital expenditures expressed as a ratio to industry shipments; productivity growth; and profitability. For a first attempt, these measures provide an indication of the overall health of the industry.

LMI's study on the defense-critical industries covered 1980 through 1985. The study concluded that defense-critical industries

- did no worse than overall manufacturers in maintaining a domestic market share in the face of substantial import growth;
- did worse than overall manufacturers in terms of adding to productive capacity, with only 41 percent of defense-critical industries matching or exceeding the overall manufacturing average growth in productive capacity;
- had 75 percent with worse-than-average growth in real shipments;
- had 62 percent with lower-than-average capital expenditures in 1980, which continued in 1985 when 72 percent had lower-than-average capital expenditures;
- had 47 percent with below-average productivity growth (17 industries actually had declining productivity); and
- achieved average or above average profitability.

These results are included in the Under Secretary's report. Tables which show the manufacturing sectors' contributions to the Gross National Products, the ranking performance of defense-critical industries, and the individual performance of selected industries are included in appendix II.

#### Other Agencies' Perspectives and Concerns

The most serious concern other agencies expressed was that DOD has not accurately represented the problems of defense-critical industries. A senior Treasury Department official with expertise on economic policy and forecasting said that the omission of important variables, such as exchange rates, in the approach used to assess the health of critical industries undermines accurate analysis. This official also expressed the view that the government still needs to identify the underlying causes of specific industry sector problems and, therefore, it seems premature to seek an action plan.

The Treasury official described another approach that would go a step further in assessing the performance of a defense-critical industry. This approach would identify the defense-critical



industries and analyze the reasons leading to their poor health. The analysis would include cyclical or macroeconomic factors, such as exchange rates, in addition to industry-specific problems. For example, if the problem was caused by a high-valued dollar and the dollar value has fallen, no action would be required. The official used the Semiconductor Manufacturing Technology Consortium, Sematech, to illustrate this point.<sup>3</sup> The official said that the Treasury Department opposed monetary assistance to the semiconductor industry because of its belief that this industry's predicament was related to a high-valued dollar and, thus, the industry would recover on its own as soon as this macroeconomic factor improved. On the other hand, the official stated that if, after all factors are analyzed, the critical industry is judged to be in trouble, then all policy options to assist the industry should be considered. This includes stockpiling; buying from the allies; relying on industry conversions, mothballed plants, or temporary subsidies geared to specific performance; and even learning to live with the deficiency. The official also said that, in considering these policies, costs as well as benefits would need to be carefully examined.

The Treasury official also suggested that the Economic Policy Council should establish a working group to (1) clarify the problems of the defense-critical industries and (2) examine the options available to address the specific problems identified. In response to this suggestion, the Under Secretary's report states that preliminary discussions concerning cooperative efforts have been held with Treasury and the Economic Policy Council.

Another important concern that the agency officials expressed about the DOD study on industrial competitiveness was its failure to prioritize the critical industries and minerals. The officials stated that prioritization is important if agencies are to adequately consider national security in their research and other program decisions and target limited resources to assist these industries. An Interior official said that once DOD

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<sup>3</sup>Sematech is a program to conduct research and development in advanced semiconductors. The Defense Advanced Research Projects Agency has responsibility for this program. The Under Secretary's report states that DOD has provided support for the semiconductor and machine tool industries to help ensure that sectors critical to national security become more internationally competitive.

establishes these priorities, then agencies can identify the critical raw material requirements and devote resources to them.

Other agencies' concerns included the need to emphasize the importance of raw materials and energy products, instead of just emphasizing manufacturing industries, to the defense industrial base, and the need to seek specific industry solutions rather than broad industrial policy. For example, an Interior official said that "maintaining a manufacturing industry does little good if raw materials and energy are not available." The official emphasized certain statements in the 1987 annual report of the Secretary of the Interior such as:

"The minerals industry . . . is responding to today's global market by restructuring to cut costs, streamline operations, and compete in an economy where new materials are emerging . . . . Over the past decade the amount of U.S. mineral industry assets held by foreign investors has almost doubled from \$9.9 billion in 1977 to \$18.8 billion in 1984 (1977 constant dollars) . . . . While the growth in foreign ownership in the minerals industry has not been without controversy, it has helped . . . from the national defense perspective maintain the Nation's overall mineral and metal self-sufficiency at reasonably high levels (and) . . . maintain viable mineral operations in the United States."

A Commerce official responsible for industrial resources programs said that defense industrial base planning should also consider the effect of military offset<sup>4</sup> agreements on the competitiveness of key defense industries. Foreign countries can use these agreements to counter competitive advantages of some U.S. industries. For example, some offset arrangements require the transfer of specific technology and production management expertise from the United States to foreign countries. The official said Commerce's position was that (1) in recent years, our allies have required a proliferation of defense offset agreements and (2) over the long run, offsets could be

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<sup>4</sup>Offsets are defined as a range of industrial and commercial compensation practices, such as coproduction, countertrade, technology transfer, mandatory subcontracting, overseas investment, licensing or other arrangements for the transfer of advanced production and processes, and management skills that other nations impose as a condition of purchase of U.S. military exports.

detrimental to our national security by weakening the competitive position of U.S. industries vital to our national security.

According to the official, through such arrangements, foreign countries seek not only to increase their military capability but also to increase employment, enhance the commercial competitiveness of current and future products, obtain advanced technology in both the military and civilian sectors, promote specific domestic industries, and gain entrance to new markets. Recent U.S. government studies have identified examples of U.S. industry sectors which offset agreements have hurt.<sup>5</sup> An example is agreements related to the gas turbine engine production base, which have resulted in the establishment of offshore manufacturing capacity that may not be available to DOD when needed. Furthermore, the transfer of technology abroad diminishes U.S. ability to compete for future business, increasing competition and decreasing the business base for subcontractors.

In response to the concerns expressed, DOD officials stated that their initial effort to identify and assess these critical industries has been beneficial because it has begun the interagency dialogue on issues important to national security. Specifically, DOD officials expressed the following views:

- DOD's efforts regarding the defense industrial base are a timely response to the congressional debate resulting from the new emphasis on conventional forces in our strategic defense. The efforts have also promoted a valuable dialogue on national security issues among the agencies that play a significant role in identifying and maintaining the defense industrial base.
- The concerns expressed by officials from other agencies are legitimate. DOD recognizes that the methodology LMI used to identify critical industries and assess the health of these industries needs to be refined, and that specific sector analyses are required. To the extent that such analysis has been limited to date, DOD recognized that it might be premature to have a strategic plan to assist these industries.

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<sup>5</sup>Gas Turbine Engine (GTE) Production Base Analysis Study, Final Report, General Research Corporation under contract to U.S. Air Force, Dayton, Ohio, February 1987. Impact of Offsets in Defense-Related Exports: A Summary of the First Three Annual Reports, Office of Management and Budget, December 1987.

- DOD's efforts, however, are first intended to reach industry and interagency consensus over a "strategic direction" so that a "strategic plan" can be prepared. A consensus exists among participants in the process that this plan must have certain elements, including a method for identifying weak sectors and assuring a broad look at potential remedies.
- Thus far, there is consensus among the agencies that DOD has to establish some sense of critical industry priorities in a systematic manner before assistance can be provided to these industries.

PROGRAMS TO ENHANCE OR MAINTAIN  
THE DEFENSE INDUSTRIAL BASE

The Under Secretary's report noted that DOD's influence on the health of the industrial base is, at the same time, significant and limited. The report also said that it is not possible for DOD to solve all the ills of the commercial manufacturing sector. For some industries, defense is a small customer. For example, defense only accounts for 12.1 percent of industry purchases of ball bearings; thus, procuring domestic bearings for most DOD uses may not be sufficient to maintain this industry. A DOD official stated that establishing research programs for many industries is not possible under current budget constraints. Even if it was possible, research alone may not enhance these industries; it has to result in low-cost production. Consequently, the official said that the limitations of DOD policy in influencing industrial sectors may require initiatives that go beyond DOD's authority. On the other hand, the Under Secretary's report noted that even in situations where DOD purchases are only a small portion of an industry sector's total output, DOD's market share can provide substantial leverage, if properly managed.

DOD's Industrial Resources Office has identified five industrywide programs established to identify and address specific problems of defense-critical industries. All of these programs are in the early stages of development. The industries involved are semiconductors, gas turbine engines, machines tools, bearings, and forgings. (See app. III.)

According to a DOD Office of Industrial Resources official, these agency programs reflect a reaction to specific industry problems and complaints, rather than a systematic analysis of problems in the defense-critical industries. An OUSTR official noted that (1) although there are mechanisms in place to investigate the

health of critical industries, it is a very difficult task and (2) it is especially difficult to establish the cause of an industry's poor health.

This OUSTR official also provided comments on programs established to identify and address specific problems of defense-critical industries. The official was enthusiastic about the program to revitalize the machine tools industry. The official saw this program as an example where a problem was resolved primarily within the industry, based on discussions among all participants in the life cycle of manufactured products, including laboratory/research scientists, production managers, and end users. The official advocated a wider use of this approach for other industries and was also enthusiastic about joint cooperative research within this industry.

Commerce has specific programs related to the defense industrial base which include identifying bottlenecks to industrial production that would be critical in the event of defense mobilization. (See pp. 11 and 12.) To assure that the United States maintains an industrial surge capability to support our national defense, Commerce investigates, under Section 232 of the Trade Expansion Act of 1962 as amended, whether the imports of a commodity are entering in such quantities or under such conditions that the production base of U.S. industries essential to national security will be impaired. Commerce provides expertise on some stockpile materials, purchase specifications, and storage requirements and assesses the economic, political, and strategic vulnerability of U.S. dependence on foreign material supplies. Commerce also generates information on offsets through its industrial capability surveys of defense-related industries.

Commerce's National Bureau of Standards (NBS) performs a number of applied research projects that contribute to the defense technology base. NBS researchers, in partnership with industry and academia, investigate areas such as electronic technology, chemistry, and manufacturing technology.

The Departments of Energy and the Interior also have research and development programs designed to enhance the defense technological base. Energy's national laboratories and manufacturing and testing facilities have technology transfer programs to encourage technology commercialization and enhance the sophistication of the industrial base. Energy has also proposed to DOD ways in which the government can facilitate cooperative industry, government, and university interaction to transfer technology to U.S. industries. Interior has several

research programs to improve exploration and mining technology. An Interior official said that the United States needs alternative methods to find new deposits and to recover the minerals that no longer can be mined economically by conventional means. These programs include research on (1) new ceramic materials for high-temperature applications and (2) substitute materials to reduce foreign dependency on chromium, cobalt, manganese, platinum, and other strategic and/or critical materials.

DEFENSE-CRITICAL INDUSTRIESAND THEIR PERFORMANCE

This appendix summarizes DOD's initial efforts to identify defense-critical industries and assess their performance. DOD contracted with LMI to perform a quick-reaction study on the defense industrial base. The tasks assigned to LMI were to (1) evaluate the overall strength of the U.S. manufacturing base and (2) assess whether the general strength or health of that base masks any weaknesses in specific defense-critical industries.

Tables II.1 through II.10 are based on LMI data. The tables show the contributions of the manufacturing sector to the Gross National Product; the defense-critical industries and their ranking by performance based on six economic indicators; and the performance of the following industries: ball and roller bearings, iron and steel forgings, screw machine products and fasteners, and semiconductors and related products.

In identifying defense-critical industries, LMI used two sources. One source was the Defense Economic Impact Modelling System. This system uses an input-output model<sup>1</sup> of the U.S. economy combined with the defense budget to estimate DOD demand for all industrial sectors. The second source was a report published by the Department of Commerce, Shipments to Federal Agencies, which contains information on the value of manufacturers' shipments to the federal government and on employees engaged in work related to government expenditures for manufactured products. LMI's evaluation of the status of the base involved identifying defense-critical industries and examining those industries' competitive positions, capacities, productivity, and profitability.

LMI's analysis, which sought to identify industrial base deficiencies from 1980 to 1985, was based on six economic indicators. These indicators were: import share of domestic market, growth in capacity, growth in shipment, capital expenditure expressed as a ratio to industry shipments, productivity growth, and profitability. LMI obtained data relating to these indicators from two sources. The Bureau of the Census provided industry characteristics, such as output,

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<sup>1</sup>An input-output model helps to analyze the interrelationship among the resources used and goods produced by various industries.

capacity, imports, and exports. The second source, the Annual Survey from Dunn and Bradstreet, provided financial data, such as profits.

The table below shows the contribution of the manufacturing sector to the Gross National Product, and indicates that little change has occurred in the relative importance of manufacturing in the U.S. economy.

Table II.1: Manufacturing Sector Share of the Gross National Product

|  | <u>Year</u> | <u>Manufacturing</u><br>(percent) |
|--|-------------|-----------------------------------|
| Share of the Gross<br>National Product | 1960        | 20.3                              |
|  | 1985        | 21.7                              |
| Average annual<br>output growth        | 1960-1985   | 3.4                               |



Table II.2: Defense-Critical Industries Ranked by Performance According to Six Economic Indicators<sup>a</sup>

| <u>Rank</u> | <u>Standard Industrial Classification<sup>b</sup></u> | <u>Industry name</u>                             |
|-------------|---|--|
| 1           | 3493  | Steel springs, except wire                       |
| 2           | 3537  | Industry trucks and tractors                     |
| 3           | 3299  | Nonmetal mineral products                        |
| 4           | 3292  | Asbestos products                                |
| 5           | 3021  | Rubber and plastic footwear                      |
| 6           | 3523  | Farm machinery and equipment                     |
| 7           | 2269  | Finishing plants, not elsewhere classified (NEC) |
| 8           | 3412  | Metal barrels, drums, and pails                  |
| 9           | 3536  | Hoists, cranes, and monorails                    |
| 10          | 3629  | Electrical industrial apparatus, NEC             |
| 11          | 3325  | Steel foundries, NEC                             |
| 12          | 3541  | Machine tools and metal cutting                  |
| 13          | 3144  | Women's footwear, except athletic                |
| 14          | 3542  | Machine tools and metal forming types            |
| 15          | 3131  | Boot and shoe cut stock and findings             |
| 16          | 237   | Fur goods  |
| 17          | 3531  | Construction machinery                           |
| 18          | 3149  | Footwear, except rubber, NEC                     |
| 19          | 3624  | Carbon and graphite products                     |
| 20          | 231   | Men's and boys' outerwear                        |
| 21          | 3552  | Textile machinery                                |
| 22          | 2393  | Textile bags                                     |
| 23          | 235   | Hats, caps, and millinery                        |
| 24          | 3636  | Sewing machinery                                 |
| 25          | 3751  | Motorcycles and bicycles                         |

<sup>a</sup>LMI ranked the economic performance of 185 industries for which data were available (1980-1985). The list shows the industries with the poorest performance first based on composite results.

<sup>b</sup>The Standard Industrial Classification (SIC) is a numerical classification used by Commerce to separate and classify industries. This classification defines industries in accordance with the composition and structure of the economy and covers the entire field of economic activities. According to LMI, industries were ranked with the idea that given limited resources, DOD could begin further studies based on the defense-critical industry ranking. An industry's importance to DOD was not among the factors included in developing the ranking.

| <u>Rank</u> | <u>Standard<br/>Industrial<br/>Classification</u> | <u>Industry name</u>   |
|-------------|---|--|
| 26          | 3532  | Mining machinery   |
| 27          | 3331  | Primary copper   |
| 28          | 3564  | Industrial and commercial fans and<br>blowers and air purification equipment |
| 29          | 3732  | Boatbuilding and repairing   |
| 30          | 3317  | Steel pipe and tubes   |
| 31          | 2869  | Industry organic chemical, NEC   |
| 32          | 2257  | Circular knit fabric mills   |
| 33          | 3111  | Leather tanning and finish   |
| 34          | 238   | Miscellaneous apparel and accessories  |
| 35          | 3334  | Primary aluminum   |
| 36          | 2865  | Cyclic crudes and intermediates  |
| 37          | 2299  | Textile goods, NEC   |
| 38          | 3425  | Hand saws and saw blades   |
| 39          | 3441  | Fabricated structural metal  |
| 40          | 3333  | Primary zinc   |
| 41          | 3562  | Ball and roller bearings   |
| 42          | 3143  | Men's footwear, except athletic  |
| 43          | 3444  | Sheet metal work   |
| 44          | 2621  | Paper mills, except building paper   |
| 45          | 3612  | Transformers   |
| 46          | 2819  | Industry inorganic chemical, NEC   |
| 47          | 2631  | Paperboard mills   |
| 48          | 3623  | Welding apparatus  |
| 49          | 3566  | Speed changers, drivers, and gears   |
| 50          | 3799  | Transportation equipment, NEC  |
| 51          | 3351  | Copper roll and draw   |
| 52          | 3341  | Secondary nonferrous metals  |
| 53          | 3499  | Fabricated metal products, NEC   |
| 54          | 3362  | Brass bronze and copper base alloy<br>foundries (castings)                   |
| 55          | 236   | Childrens' outerwear   |
| 56          | 2911  | Petroleum refining   |
| 57          | 232   | Men's and boys' furnishings  |
| 58          | 3715  | Truck trailers   |
| 59          | 2011  | Meat packing plants  |
| 60          | 3693  | X-ray apparatus and tubes  |
| 61          | 3496  | Miscellaneous fabricated wire products                                       |
| 62          | 3462  | Iron and steel forgings  |
| 63          | 3321  | Gray iron foundries  |
| 64          | 3443  | Fabricated plate work (boiler shops)   |
| 65          | 3714  | Motor vehicle parts and accessories  |
| 66          | 3699  | Electric equipment and supplies, NEC   |

| <u>Rank</u> | <u>Standard<br/>Industrial<br/>Classification</u> | <u>Industry name</u>  |
|-------------|---|---|
| 67          | 3676  | Electronic resistors  |
| 68          | 3675  | Electronic capacitors                                       |
| 69          | 3535  | Conveyors and convey equipment                              |
| 70          | 3644  | Noncurrent car wiring                                       |
| 71          | 3585  | Refrigeration and heat equipment                            |
| 72          | 3873  | Watches and clocks  |
| 73          | 233   | Women's and misses' outerwear                               |
| 74          | 3546  | Power-driven hand tools                                     |
| 75          | 3731  | Shipbuilding and repair                                     |
| 76          | 2822  | Synthetic rubber  |
| 77          | 3643  | Current car-wiring devices                                  |
| 78          | 3561  | Pumps and pumping equipment                                 |
| 79          | 3315  | Steel wire and related products                             |
| 80          | 3621  | Motors and generators                                       |
| 81          | 3711  | Motor vehicles and car bodies                               |
| 82          | 3423  | Hand and edge tools, NEC                                    |
| 83          | 3041  | Rubber and plastic hose                                     |
| 84          | 3651  | Radio and TV reception sets                                 |
| 85          | 3549  | Metalworking, machinery, NEC                                |
| 86          | 2231  | Weaving, finish mills, and wool                             |
| 87          | 2298  | Cordage and twine   |
| 88          | 3569  | General industry machinery and<br>equipment, NEC            |
| 89          | 345   | Screw machine products and fasteners                        |
| 90          | 2542  | Metal partitions and fixtures                               |
| 91          | 3533  | Oil field machinery   |
| 92          | 3581  | Automatic merchandise machinery                             |
| 93          | 3339  | Prime nonferrous metals, NEC                                |
| 94          | 3589  | Service industry machinery, NEC                             |
| 95          | 3316  | Cold finishing steel shapes                                 |
| 96          | 3679  | Electronic components, NEC                                  |
| 97          | 265   | Paperboard containers and boxes                             |
| 98          | 3691  | Storage batteries   |
| 99          | 3484  | Small arms  |
| 100         | 3433  | Heating equipment, except electric and<br>warm air furnaces |
| 101         | 2211  | Weaving mills, cotton                                       |
| 102         | 234   | Women's and misses' undergarments                           |
| 103         | 3211  | Flat glass  |
| 104         | 3011  | Tires and inner tubes                                       |
| 105         | 3825  | Electric measuring instruments                              |
| 106         | 3494  | Valves and pipe fittings                                    |
| 107         | 3743  | Railroad equipment  |

| <u>Rank</u> | <u>Standard<br/>Industrial<br/>Classification</u> | <u>Industry name</u>  |
|-------------|---|---|
| 108         | 3353  | Aluminum sheet, plate, and foil   |
| 109         | 3357  | Drawing and insulating of nonferrous<br>wire  |
| 110         | 2221  | Weaving mills and synthetics  |
| 111         | 3841  | Surgical and medical instruments  |
| 112         | 3677  | Electronic coils and transformers   |
| 113         | 3545  | Machine tool accessories  |
| 114         | 2821  | Plastic mats and resins   |
| 115         | 3229  | Pressed and blown glass, NEC  |
| 116         | 2281  | Yarn mills, except wool   |
| 117         | 3511  | Steam, gas, hydraulic turbines, and<br>turbine generator set units                        |
| 118         | 3312  | Blast furnaces and steel mills  |
| 119         | 2891  | Adhesives and sealants  |
| 120         | 2296  | Tire cord and fabric  |
| 121         | 3622  | Industrial controls   |
| 122         | 2812  | Alkalies and chlorine   |
| 123         | 3555  | Printing trades machinery   |
| 124         | 3579  | Office machinery, NEC   |
| 125         | 3291  | Abrasive products   |
| 126         | 2899  | Chemical and chemical preparations, NEC   |
| 127         | 3721  | Aircraft  |
| 128         | 3293  | Gaskets, packing, and sealing   |
| 129         | 3231  | Glass products made of purchased glass  |
| 130         | 382   | Laboratory apparatus and analytical<br>optical, measuring, and controlling<br>instruments |
| 131         | 3692  | Primary batteries, wet and dry  |
| 132         | 3354  | Aluminum extruded products  |
| 133         | 2892  | Explosives  |
| 134         | 3498  | Fabricated pipe and fittings  |
| 135         | 3356  | Nonferrous roll and draw, NEC   |
| 136         | 3573  | Electronic computing equipment  |
| 137         | 3142  | House slippers  |
| 138         | 3861  | Photo equipment and supplies  |
| 139         | 3661  | Telephone and telegraph apparatus   |
| 140         | 3694  | Engineer electric equipment   |
| 141         | 3429  | Hardware, NEC   |
| 142         | 3411  | Metal cans  |
| 143         | 3519  | Internal combustion engines, NEC  |
| 144         | 3674  | Semiconductors and related  |

| <u>Rank</u> | <u>Standard<br/>Industrial<br/>Classification</u> | <u>Industry name</u>   |
|-------------|---|--|
| 145         | 3568  | Mechanical power transmission equipment,<br>NEC                              |
| 146         | 3544  | Special dies and tools, die sets, jigs<br>and fixtures, and industrial molds |
| 147         | 2258  | Warp knit fabric mills   |
| 148         | 2816  | Inorganic pigments   |
| 149         | 2992  | Lube oils and greases  |
| 150         | 2261  | Finishing plants and cotton  |
| 151         | 3567  | Industrial furnaces and ovens  |
| 152         | 2262  | Finish plants and synthetics   |
| 159         | 3399  | Primary metal products, NEC  |
| 160         | 3999  | Manufacturing industries, NEC  |
| 161         | 3471  | Plating and polishing  |
| 162         | 2297  | Nonwoven fabrics   |
| 163         | 3361  | Aluminum foundries   |
| 164         | 3079  | Miscellaneous plastic products   |
| 165         | 3613  | Switchgear and switchboards  |
| 166         | 2397  | Schiffli machine embroideries  |
| 167         | 3563  | Air and gas compressors  |
| 168         | 3728  | Aircraft parts and auxiliary equipment,<br>NEC                               |
| 169         | 3641  | Electric lamps   |
| 170         | 3559  | Special industry machinery, NEC  |
| 171         | 3466  | Crown and enclosures   |
| 172         | 2396  | Automotive and apparel trimmings   |
| 173         | 3069  | Fabricated rubber products, NEC  |
| 174         | 2813  | Industrial gases   |
| 175         | 3724  | Aircraft engines and engine parts  |
| 176         | 2449  | Wood containers, NEC   |
| 177         | 3662  | Radio and TV communication equipment   |
| 178         | 3497  | Metal foil and leaf  |
| 179         | 3495  | Wire springs   |
| 180         | 3592  | Carburetors, pistons, piston rings, and<br>valves                            |
| 181         | 2399  | Fabric textile products, NEC   |
| 182         | 3811  | Engineer and science instruments   |
| 183         | 3761  | Guided missiles, space vehicles  |
| 184         | 3993  | Signs and advertisement displays   |
| 185         | 3842  | Surgical appliances and supplies   |

Table II.3: Defense Share of Industry Purchases for Selected Industries

| <u>SIC codes</u> | <u>Industry name and DEIMS code</u>        | <u>Defense purchases</u><br>(dollars in millions) | <u>Defense share of industry purchases</u><br>(percent) | <u>LMI ranking<sup>a</sup> in terms of dollars spent</u> |
|------------------|--|---|---|--|
| 3562             | Ball and roller bearings (295)             | \$ 454  | 12.1  | 65   |
| 3462             | Iron and steel forgings (229)              | 563   | 15.0  | 54   |
| 345              | Screw machine products and fasteners (257) | 1,261   | 15.4  | 27   |
| 3674             | Semiconductors (335)                       | 4,065   | 27.6  | 13   |

<sup>a</sup>LMI ranked 164 industries, for which data were available, accounting for a total of \$192.9 billion in defense purchases. DEIMS Industry Code 333, Radio and TV Equipment, which accounted for \$32.6 billion in defense purchases, had the highest share (50.9 percent) of its output going to defense as opposed to commercial customers. Semiconductors ranked 13th with 27.6 percent of this industry's output going to defense.

Table II.4: Import Share for Selected Industries<sup>a, b</sup>

| <u>SIC</u><br><u>code</u> | <u>Industry name</u>                             | <u>1980</u>           | <u>1985-86</u> |
|---------------------------|--|-----------------------|----------------|
|                           |  | ----- (percent) ----- |                |
| 3562                      | Ball and roller bearings                         | 12.2                  | 16.6           |
| 3462                      | Iron and steel forgings                          | 3.7                   | 2.4            |
| 345                       | Screw machine products and fasteners             | 0.0                   | 10.0           |
| 3674                      | Semiconductors and related products <sup>c</sup> | 31.7                  | 30.4           |

<sup>a</sup>According to LMI, import share is the primary indicator of U.S. competitiveness and is defined as the ratio of imports to apparent domestic consumption (domestic production plus imports minus exports). Imports for all manufacturing accounted for 8.1 percent of U.S. apparent consumption in 1980 and increased to 14.3 percent by 1985.

<sup>b</sup>LMI calculated import share for 167 defense-critical industries for which data were available. For all of these defense-critical industries, imports captured 12.0 percent of U.S. apparent consumption in 1980 and increased to 17.1 percent by 1985-86.

<sup>c</sup>In 1980, semiconductors and related products had one of the largest import shares (31.7 percent) among the critical industries surveyed. The import share dropped slightly to 30.4 percent by 1986.

Table II.5: Change in Capacity for Selected Industries<sup>a,b,c</sup>

| <u>SIC code</u> | <u>Industry name</u>                 | <u>1980 capacity</u>  | <u>1985 capacity</u> | <u>Average annual change</u> |
|-----------------|--------------------------------------|-----------------------|----------------------|------------------------------|
|                 |                                      | (dollars in millions) |                      | (percent)                    |
| 3562            | Ball and roller bearings             | \$ 4,660.9            | \$4,760.3            | 0.4                          |
| 3462            | Iron and steel forgings              | 6,683.8               | 5,530.8              | -3.5                         |
| 345             | Screw machine products and fasteners | 10,351.2              | 9,647.2              | -1.4                         |
| 3674            | Semiconductors and related products  | 12,651.6              | 20,790.4             | 12.9                         |

<sup>a</sup>According to LMI, capacity growth is the second most important indicator of an industry's health in physical product capacity. The measure of capacity growth that LMI selected is practical capacity; that is, the maximum level of production possible with the equipment in place and a realistic work schedule. LMI computed capacity by dividing actual shipments in real dollars by practical capacity use--the maximum level of production possible with the equipment in place and a realistic workforce.

<sup>b</sup>From 1980 through 1985, U.S. manufacturing capacity grew 1.5 percent annually. Of 160 defense-critical industries for which capacity data was available, 94 industries (59 percent) performed below the overall growth in capacity of manufacturing as a whole. The defense industries with the greatest decline in capacity were: aluminum rolling and drawing, steel foundries, industrial trucks and tractors, and primary copper.

<sup>c</sup>During 1980 through 1985, the average annual change in capacity of the 160 defense-critical industries for which data were available was plus 2.4 percent.



Table II.6: Average Annual Percentage Change in Manufacturers' Shipments (Measured in 1980 Dollars) for Selected Industries<sup>a,b,c</sup>

| <u>SIC code</u> | <u>Industry name</u>                 | <u>1980-85</u>        | <u>1980-86</u> |
|-----------------|--------------------------------------|-----------------------|----------------|
|                 |                                      | ----- (percent) ----- |                |
| 3562            | Ball and roller bearings             | -2.9                  | -2.1           |
| 3462            | Iron and steel forgings              | -5.0                  | Not available  |
| 345             | Screw machine products and fasteners | 0.6                   | Not available  |
| 3674            | Semiconductors and related products  | 4.9                   | 4.9            |

<sup>a</sup>Manufacturers' shipments are a measure of the activity in each defense-critical industry. A negative or low growth in this indicator demonstrates slow demand growth, that may lead to reduced investment and capacity growth.

<sup>b</sup>All manufacturing industries combined experienced an average constant dollar growth in shipments of 1.4 percent per year between 1980 and 1985. Ball and roller bearings is one of 105 defense-critical industries that actually experienced declines in shipments between 1980 and 1985.

<sup>c</sup>Overall, the 213 defense-critical industries for which data were available experienced an average constant dollar growth in shipments of 0.8 percent per year between 1980 and 1985.

Table II.7: Investment Ratios for Selected Industries<sup>a,b,c</sup>

| <u>SIC</u><br><u>code</u> | <u>Industry name</u>                 | <u>1980</u>           | <u>1985-86</u> |
|---------------------------|--------------------------------------|-----------------------|----------------|
|                           |                                      | ----- (percent) ----- |                |
| 3562                      | Ball and roller bearings             | 7.1                   | 3.8            |
| 3462                      | Iron and steel forgings              | 4.3                   | 3.3            |
| 345                       | Screw machine products and fasteners | 3.9                   | 3.2            |
| 3674                      | Semiconductors and related products  | 15.2                  | 17.2           |

<sup>a</sup>Investment ratios are measured by capital expenditures as a percentage of shipment values. Industries undertake capital expenditures to maintain or expand productive capacity and to improve productivity. Overall manufacturing capital expenditure for 1980 through 1985 represented 3.8 percent of manufacturers' shipments in 1980 and increased to 4.3 percent by 1985.

<sup>b</sup>In 1980, data available for 214 defense-critical industries showed that 62 percent of these industries performed below the average level of the overall manufacturing sector and by 1985 that percentage had changed to 72 percent. The semiconductors and related products category, however, shows an investment ratio well above that of the overall manufacturing sector.

<sup>c</sup>For defense-critical industries, capital expenditures were 3.8 percent of shipment values in 1980 and decreased to 3.6 percent in 1985-86.

Table II.8: Change in Productivity for Selected Industries<sup>a,b</sup>

| <u>SIC code</u> | <u>Industry name</u>                 | <u>1980</u>           | <u>1985-86</u> | <u>Average annual change 1980/1985-86</u> |
|-----------------|--------------------------------------|-----------------------|----------------|---|
|                 |                                      | (dollars in millions) |                | (percent)                                 |
| 3562            | Ball and roller bearings             | \$ 81.54              | \$ 94.39       | 2.6                                       |
| 3462            | Iron and steel forgings              | 116.63                | 129.33         | 2.2                                       |
| 345             | Screw machine products and fasteners | 74.42                 | 94.28          | 5.3                                       |
| 3674            | Semiconductors and related products  | 120.28                | 179.80         | 8.2                                       |

<sup>a</sup>productivity is measured by shipments per worker in constant dollars.

<sup>b</sup>For manufacturing as a whole, real shipments per production worker grew at an annual rate of 3.8 percent between 1980 and 1985. For the defense-critical industries for which data were available, shipments per production worker grew at an annual rate of 4.2 percent between 1980 and 1985.

Table II.9: Annual Profit Margin for Selected Industries<sup>a,b,c</sup>

| <u>SIC code</u> | <u>Industry name</u>                 | <u>1980</u>           | <u>1985-86</u> |
|-----------------|--------------------------------------|-----------------------|----------------|
|                 |                                      | ----- (percent) ----- |                |
| 3562            | Ball and roller bearings             | 4.9                   | 5.0            |
| 3462            | Iron and steel forgings              | 4.8                   | 4.5            |
| 345             | Screw machine products and fasteners | 6.1                   | 4.6            |
| 3674            | Semiconductors and related products  | 7.8                   | 3.5            |

<sup>a</sup>Profitability is another indicator of the health of an industry. Sufficient profitability enables industries to attract new investment capital, relieve pressure on wages and salaries, and sustain research and development expenditures. (See table II.10.) The measure of profitability used in this table is return on sales.

<sup>b</sup>All manufacturing industries combined earned a profit of 4.9 percent on sales in 1980 and 3.7 percent in 1986. All of the selected industries shown above, except semiconductors, performed above the 1986 average for manufacturing as a whole. Semiconductors' annual profit margin declined to 3.5 percent in 1986.

<sup>c</sup>Overall, the defense-critical industries for which data were available earned a 4.9 percent profit in 1980 and 4.3 percent in 1986.

Table II.10: Average Annual Return on Fixed Assets for Selected Industries<sup>a, b, c</sup>

| <u>SIC</u><br><u>code</u> | <u>Industry name</u>                 | <u>1980</u>           | <u>1985-86</u> |
|---------------------------|--------------------------------------|-----------------------|----------------|
|                           |                                      | ----- (percent) ----- |                |
| 3562                      | Ball and roller bearings             | 31.5                  | 50.8           |
| 3462                      | Iron and steel forgings              | 34.2                  | 26.0           |
| 345                       | Screw machine products and fasteners | 36.2                  | 35.9           |
| 3674                      | Semiconductors and related products  | 92.3                  | 30.2           |

<sup>a</sup>Return on fixed assets, which is another measure of profitability used in LMI's analysis, relates after-tax profit to the facilities capital used to produce the related products.

<sup>b</sup>In 1980, return on fixed assets averaged 18.1 percent for all manufacturing. This average declined to 11.3 percent in 1986. All the selected defense industries shown above performed above the manufacturing averages. However, with the exception of ball and roller bearings, the annual return on fixed assets deteriorated for these selected defense industries. Semiconductors' performance deteriorated significantly during 1980-1986.

<sup>c</sup>Overall, in 1980, return on fixed assets averaged 52.3 percent for the defense-critical industries for which data were available. This average increased to 54.3 percent in 1986.

PROGRAMS TO ASSIST DEFENSE-CRITICAL INDUSTRIES

DOD's Industrial Resources Office identified five industrywide programs to enhance and support industries critical to DOD. These programs are in the early stages of development. An overview of these programs follows.

-- Programs in their initial stages are:

- **Semiconductors:** The objectives of this program are to conduct research and development on advanced semiconductor manufacturing techniques and develop techniques to adapt manufacturing expertise to a variety of semiconductor products. To meet these objectives, Sematech, a consortium of semiconductor manufacturers, received a DOD grant of \$100 million per year for the next 2 years. DOD and Sematech signed a Memorandum of Understanding in May 1988, which serves as overall guidance to initiate this work.
- **Gas turbine engines:** The Air Force, as part of its production base analysis, commissioned a study to determine the capability of DOD prime contractors and subcontractors in the gas turbine engine sector of the industrial base to surge and/or mobilize under crisis conditions. The study, completed in February 1987, concluded that while the propulsion sector was likely to meet its goals, there was reason for concern about the subcontractor base capability. In response to the study's conclusions and recommendations, FEMA has awarded a contract to initiate additional analysis relating to the need for Voluntary and Standby Agreements among the federal government, the prime contractors, and the subcontractors.
- Programs with implementation guidance and some activity relating to machine tools, bearings, and forgings.
- **Machine tools:** The overall objective of this program, with joint Commerce and DOD participation, is to revitalize the domestic machine tool industry. A total of \$10 million was appropriated in DOD's fiscal year 1988 budget for the machine tools program. Commerce, the lead agency for the overall program, is scheduled to issue a status report on the various actions within this program by September 1988.

The program centers on four primary tasks.

1. Integrating the industry more fully into the defense procurement process through more timely procurement information and requirements.

Methodology example:

DOD will make the DEIMS available to firms with quantitative planning models. DEIMS is used to estimate DOD demand for all industrial sectors and thus, provides information on projected defense industrial base purchases of machine tools over the next 5 years.

2. Linking the industry with on-going defense programs to improve manufacturing technology.

Methodology example:

DOD is establishing machine tool technology development as a major area of focus within its Manufacturing Technology<sup>1</sup> research and development funding program. The National Machine Tools Builders Association has held two government-industry conferences to identify specific areas of machine tool and manufacturing technology most in need of research and development.

3. Providing DOD matching funds over the next 3 years (\$5 million per year) to support the National Center for Manufacturing Science, a private sector program which will conduct advance manufacturing technology research and share the results with member companies.

Methodology Example:

U.S. machine tool manufacturers and other potential users established the National Center for Manufacturing Science. It has over 100 member firms and binding contracts in excess of \$5 million per year. Some of the member firms include General Motors, Ford Motor Co., Intel Corp., General Dynamics, Texas Instruments, and many other machine tool related firms.

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<sup>1</sup>The DOD Manufacturing Technology program is intended to improve the productivity and responsiveness of the U.S. defense industrial base by funding the development of manufacturing technologies. The program provides seed funding for development of processes and equipment technology which permits contractors to upgrade their manufacturing capabilities.

4. Improving industries' performance through a variety of other activities:

Methodology Examples:

Expediting Federal Licensing Procedures--Commerce has implemented the development of expedited processing techniques for applications involving machine tool exports.

Expanding Markets for Advanced Manufacturing--The Navy's Office of Rapid Acquisition of Manufacturing Parts and the State of South Carolina are engaged in a joint project to develop and demonstrate advanced manufacturing technology.

Productivity and Marketing Programs Providing Federal Services to Enhance the International Competitiveness of the Domestic Machine Tool Industry--The programs provide financing of foreign sales; expedited treatment of export trading company certificates that give antitrust protection for certain export activities; and market promotion.

- **Bearings:** The program's objective is to revitalize the U.S. bearings industry. In January 1987, the Air Force awarded a contract for \$2.3 million to implement the program and allocated an additional \$1.3 million to the



program in its fiscal year 1988 budget. This program is included in the Air Force Industrial Modernization Incentive Program (IMIP).<sup>2</sup>

- **Forgings:** The overall objectives of the program are reducing manufacturing lead times and acquisition costs and encouraging competition to modernize the forging industry. The Air Force has awarded contracts to five companies. The program started in fiscal year 1985 at a cost of \$1.86 million, which the Air Force continued to fund in fiscal year 1986 at \$1 million, fiscal year 1987 at \$1.5 million, and fiscal year 1988 at \$2.4 million. The Air Force's IMIP includes the forging program.

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<sup>2</sup>IMIP is a joint venture between the government and industry to accelerate the implementation of modern equipment and management techniques in the industrial base. Implementation at a contractor facility takes place in three phases. Phase I consists of a factory analysis which evaluates the needs of the overall facility and identifies potential manufacturing technologies/modernizations opportunities. Phase II identifies implementation plans, specifies hardware/software requirements and validates specific applications through demonstrations, prototypes, and so forth. Phase III implements the plan, including contractor purchase and installation of capital equipment and the implementation of management procedures to support the new manufacturing processes. Both the Bearings and Forgings programs are in phase II.

LISTING OF SELECTED STUDIES AND REPORTS  
DEALING WITH DEFENSE-CRITICAL INDUSTRIES

This appendix provides information on selected studies and reports that discuss agencies' actions, proposals, and views on defense-critical industries.

| <u>Date</u> | <u>Industry</u>      | <u>Title</u>  | <u>Organization</u>  |
|-------------|----------------------|---|--|
| Nov. 1985   | Electronics          | Technical Assessment of U.S. Electronics Dependency                                     | Institute for Defense Analyses   |
| June 1986   | Bearings             | Joint Logistics Commanders Bearing Study  | DOD, <sup>a</sup> Joint Logistics Commanders, Joint Group on the Industrial Base |
| Feb. 1987   | Gas turbine engine   | Gas Turbine Engine Production Base Analysis Study, Final Report                         | General Research Corporation for the Air Force Systems Command                   |
| Feb. 1987   | Semiconductors       | Defense Semiconductor Dependency  | Defense Science Board Task Force on "Defense Semiconductor Dependency"           |
| Mar. 1987   | Industrial fasteners | An Economic Assessment of the United States Industrial Fastener Industry (1979 to 1986) | U.S. Department of Commerce, International Trade Commission                      |
| Apr. 1987   | Investment casting   | Army Investment Casting Industry Report   | U.S. Army Industrial Base Engineering Activity                                   |

<sup>a</sup>The Department of Commerce, Office of Industrial Resources Administration, collected and analyzed data included in this report.

## APPENDIX IV

## APPENDIX IV

| <u>Date</u> | <u>Industry</u>    | <u>Title</u>                                       | <u>Organization</u>  |
|-------------|--------------------|--|--|
| June 1987   | Precision optics   | Joint Logistics Commanders Precision Optics Study  | DOD, <sup>a</sup> Joint Logistics Commanders, Joint Group on the Industrial Base |
| Dec. 1987   | Investment casting | Investment Casting: A National Security Assessment | U.S. Department of Commerce, International Trade Commission                      |

DOD PRIME CONTRACT AWARDSTO FOREIGN SOURCES

This appendix provides data on DOD prime contract awards to foreign sources and data on the products and services that accounted for the vast majority of the dollar value of DOD awards to foreign sources in recent years. The data does not show significant increases in the value of DOD prime contract awards to foreign sources. Because systematic information on DOD subcontract awards is not available and would be costly to develop, we did not identify foreign source procurement at the subcontractor level.

We obtained the information on DOD prime contract awards from the Individual Contracting Actions Report (Form DD-350). These forms are used for reporting information on DOD procurement actions over \$25,000.

Effective at the beginning of fiscal year 1984, DOD modified the Form DD-350: (1) the category "Work Outside U.S. and Possessions", which included work performed by either U.S. or foreign firms, was deleted and (2) a new category, "Foreign Concern" was added. Therefore, we cannot combine the data on foreign source procurement to show trends over the fiscal years 1980 through 1987. (See tables V.1 to V.3.)

Table V.1: Dollar Value of DOD Contracts From Fiscal Years 1980 Through 1983 by U.S. Purchasing Offices and by Types of Business<sup>a</sup>

| <u>FY</u>                         | <u>Total procurement</u> | <u>Total procurement less foreign military sales</u> | <u>Work outside United States and possessions<sup>b</sup></u> | <u>Awarded to overseas firms for work in the United States</u> |
|-----------------------------------|--------------------------|--|---|--|
| ------(dollars in thousands)----- |                          |  |   |  |
| 1980                              | \$ 76,806,327            | \$ 67,339,850  | \$4,888,648<br>(.07259)                                       | \$55,219<br>(.00082)   |
| 1981                              | 97,388,425               | 88,362,674   | 5,999,675<br>(.06789)   | 45,915<br>(.00051)   |
| 1982                              | 116,659,445              | 104,775,811  | 6,967,655<br>(.06650)   | 35,646<br>(.00034)   |
| 1983                              | 128,242,123              | 119,805,115  | 6,433,924<br>(.05370)   | 18,741<br>(.00015)   |

<sup>a</sup>Source: DOD Individual Contracting Action Report (Form DD-350).

<sup>b</sup>This category, which was deleted from the Form DD-350 after Fiscal Year 1983, includes work performed by either U.S. or foreign firms located outside the United States and its possessions.

Table V.2: Dollar Value of DOD Contracts From Fiscal Years 1984 Through 1987 by U.S. Purchasing Offices and by Types of Business<sup>a</sup>

| <u>FY</u>                         | <u>Total procurement</u> | <u>Total procurement less foreign military sales</u> | <u>Foreign concern</u> | <u>Percent<sup>b</sup></u> |
|-----------------------------------|--------------------------|--|------------------------|----------------------------|
| ------(dollars in thousands)----- |                          |  |                        |                            |
| 1984                              | \$133,571,312            | \$125,018,747  | \$5,372,843            | 04.298                     |
| 1985                              | 150,674,308              | 139,912,096  | 6,067,711              | 04.337                     |
| 1986                              | 145,742,058              | 137,542,840  | 6,630,159              | 04.820                     |
| 1987                              | 92,854,467               | 88,507,900   | 3,862,118              | 04.364                     |

<sup>a</sup>Source: DOD Individual Contracting Action Report (Form DD-350).

<sup>b</sup>These percentages are derived by dividing the value of awards to foreign concerns (the fourth column) by the value of total procurement less foreign military sales (the third column).

Table V.3: Highest Foreign Concern Values for Fiscal Years 1984 through 1987,<sup>a</sup>  
Products and Services

|   | <u>FY 1984</u><br><u>Value</u> | <u>FY 1985</u><br><u>Value</u> | <u>FY 1986</u><br><u>Value</u> | <u>FY 1987</u><br><u>Value</u> |
|---|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Dollars in thousands (and percent of the total value of contracts for all products and services which were awarded to foreign concerns) |                                |                                |                                |                                |
| <u>Products</u>   |                                |                                |                                |                                |
| Fuel, lubricants, and oils and waxes  | \$1,618,847<br>(30.1302)       | \$1,513,342<br>(24.9409)       | \$1,740,046<br>(26.2444)       | \$ 809,707<br>(20.9654)        |
| Engines, turbines, and components   | 248,702<br>(4.6289)            | 213,877<br>(3.5248)            | 296,264<br>(4.4684)            | 90,826<br>(2.3517)             |
| Ammunition and explosives   | 45,617<br>(.8490)              | 66,441<br>(1.0950)             | 136,663<br>(2.0612)            | 83,621<br>(2.1652)             |
| Communication, detection, and radiation equipment   | 85,028<br>(1.5826)             | 87,399<br>(1.4404)             | 123,455<br>(1.8620)            | 61,276<br>(1.5866)             |
| Subsistence   | 55,531<br>(1.0335)             | 62,513<br>(1.0303)             | 80,398<br>(1.2126)             | 50,386<br>(1.3046)             |
| Aircraft components and accessories   | 46,026<br>(.8566)              | 71,566<br>(1.1795)             | 56,503<br>(.8522)              | 37,077<br>(.9600)              |
| Guided missiles   | 30,594<br>(.5694)              | 70,566<br>(1.1604)             | 115,060<br>(1.7354)            | 36,496<br>(.9450)              |
| Ground effect vehicles, motor vehicles, trailers, and cycles  | 149,936<br>(2.7906)            | 278,157<br>(4.5842)            | 88,810<br>(1.3395)             | 24,638<br>(.6379)              |
| Fire fighting rescue and safety equipment   | 9,210<br>(.1714)               | 7,115<br>(.1173)               | 20,331<br>(.3066)              | 23,240<br>(.6017)              |

<sup>a</sup>Includes only the first three quarters for fiscal year 1987.

## APPENDIX V

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|   | <u>FY 1984</u><br>Value | <u>FY 1985</u><br>Value | <u>FY 1986</u><br>Value | <u>FY 1987</u><br>Value |
|---|-------------------------|-------------------------|-------------------------|-------------------------|
| Dollars in thousands (and percent of the total value<br>of contracts for all products and services which were<br>awarded to foreign concerns) |                         |                         |                         |                         |
| <u>Services</u>   |                         |                         |                         |                         |
| Maintenance, repair and<br>rebuilding equipment   | \$ 108,314<br>(2.0160)  | \$ 144,150<br>(2.3757)  | \$ 201,977<br>(3.0463)  | \$ 185,931<br>(4.8142)  |
| Operation of government-<br>owned facility  | 545,036<br>(10.1443)    | 564,557<br>(9.3043)     | 633,526<br>(9.5552)     | 624,608<br>(16.1727)    |
| Utilities and housekeeping  | 391,722<br>(7.2908)     | 415,570<br>(6.8489)     | 489,442<br>(7.3821)     | 436,050<br>(11.2904)    |
| Transportation and travel   | 97,412<br>(1.8130)      | 86,475<br>(1.4252)      | 70,554<br>(1.0641)      | 79,349<br>(2.0545)      |
| Construction of structures<br>and facilities  | 550,605<br>(10.2479)    | 820,606<br>(13.5241)    | 882,702<br>(13.3134)    | 270,894<br>(7.0141)     |
| Maintenance, repair or<br>alteration of real<br>property  | 769,142<br>(14.3154)    | 852,899<br>(14.0564)    | 798,710<br>(12.0466)    | 525,199<br>(13.5987)    |
| Total awards to<br>foreign concerns for<br>all products and<br>services   | \$5,372,843             | \$6,067,711             | \$6,630,159             | \$3,862,118             |



OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our review were to (1) obtain information regarding the viability of American defense industries that are critical to the defense industrial base, (2) assess the methodology LMI used to evaluate the strength of the defense industrial base, and (3) obtain information on DOD's prime contracts awards to foreign sources.

In gathering data on the viability of the defense industrial base, we:

- Identified all federal agencies that play a significant role in maintaining the base and strengthening industries DOD deems to be critical to national security.
- Attempted to identify what these agencies are doing to identify such industries, including industries at the subcontractor level.
- Determined what actions the agencies have taken and what proposals they have made to enhance or maintain the viability of industries identified as critical to national security.
- Obtained DOD's views on and response to the needs of the following industries: (1) fasteners, (2) ball bearings, (3) metal chains, (4) forging and casting, (5) semiconductors, and (6) electronic components other than semiconductors.

We interviewed DOD and other agencies' officials with responsibilities for the defense industrial base and related areas. These senior level officials, who represented their respective agencies in interagency discussions coordinated by FEMA, provided their views and reactions to DOD's draft report on bolstering industrial competitiveness. We attended the Defense Industrial Strategy Conference, where experts from academia and industry and high-level government officials commented on DOD's preliminary draft report. We also attended the Annual DOD Tri-Service Manufacturing Technology Advisory Group conference, which provided information on the problems of the manufacturing sector and DOD programs to address these problems.

We analyzed the study LMI prepared for DOD, Identifying Industrial Base Deficiencies, and interviewed the officials responsible for the study to discuss their analysis of defense-critical industries.

We obtained information on DOD's prime contract awards to foreign sources from the Individual Contracting Actions Report (form DD-350), which provides information on DOD procurement actions over \$25,000.

We performed our review during December 1987 through March 1988 in accordance with generally accepted government auditing standards.

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